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10/722,651	11/26/2003	Mansoor Ali Khan Alicherry	6-3	7650

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EXAMINER	
THORNEWELL, KIMBERLY A	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/722,651	KHAN ALICHERRY ET AL.	
	Examiner	Art Unit	
	Kimberly Thornewell	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 March 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *8,11,22 and 25* is/are allowed.

6)☒ Claim(s) *1-7,9,10,12-21,23,24 and 26-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. In the Office Action dated 12/29/2006, claims 1-7, 9, 15-21, 23-24 and 26-29 were rejected. In the reply dated 3/29/2007, Applicants amended claims 8, 11, 22 and 25, and therefore claims 1-29 are pending in the instant application.

Response to Arguments

Claim Objections

2. In view of Applicants' arguments, and upon further consideration, the objection to the term "polynomially" in claims 9 and 23 is withdrawn.

Claim Rejections, 35 USC § 103

3. Applicant's arguments filed 3/29/2007 have been fully considered but they are not persuasive.

4. Regarding claims 1, 15 and 29, Applicants argued that Bar-Noy does not disclose obtaining a set of one or more demands for use in computing a line design system (Remarks page 8 second full paragraph). Applicants further argued that there is no suggestion in Bar-Noy to have colors represent bandwidths such that bandwidths are assigned (Remarks page 9).

In response to the argument that Bar-Noy does not disclose obtaining a set of one or more demands for use in computing a line system design, it is noted that the features upon which applicant relies (i.e., demand generally referring to a bandwidth request between nodes) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988

F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). By referring to the specification, it appears that Applicants are attempting to present an explicit definition for the term "demands." However, the cited portion of the specification states, "the term 'demand' generally refers to a bandwidth request between nodes. For example, a demand may be made for a wavelength between OADM 106-2 and end terminal 102-2 in FIG. 1." The phrases "generally refers to" and "may be made" render this citation as an exemplary embodiment of a demand, rather than a precise, deliberate and clear definition of the term.

Furthermore, even if the feature of a demand referring to a bandwidth request between nodes was claimed, the Examiner would respectfully traverse the argument that the feature is not taught by Bar-Noy. For example, the Examiner directs Applicant's attention to page 5 of Bar-Noy, first paragraph under the section "Applications." This section teaches that nodes represent processors, and that the processors are requesting resources. As is known in the art, processors request (demand) resources (bandwidth) in order to complete jobs (see, for example, US Patent no. 6,662,297, to Boom et al.). As the number of processors in a design increases, the number of communication links increases, and hence, the amount of bandwidth to be allocated increases. Therefore, the Examiner respectfully submits that Bar-Noy teaches the claimed feature of obtaining a set of one or mar demands for use in computing the line system design.

As to the argument that there is no suggestion in Bar-Noy to have colors represent bandwidths such that bandwidths are assigned, the Examiner respectfully points to page 20 fifth paragraph in Bar-Noy, where the results of Sections 3 and 4 are applied to the resource allocation problem. The processors are colored such that the color indicates the maximal length of a waiting chain of that processor. As discussed above, the processors send requests for resources,

which inherently includes bandwidth. As is discussed in Bar-Noy on page 20 fifth paragraph, it is a goal to minimize resources by minimizing the average response time. Because, as is known in the art, bandwidth is inherently one of the resources allocated to processors to complete jobs, it would have been obvious to modify the teachings of Bar-Noy to have the colors represent bandwidths such that bandwidths are assigned.

Because it would have been obvious to modify the teaching of Bar-Noy to include each and every limitation of Applicants' claims 1 and 15, the rejection of claims 1 and 15 under 35 USC 103(a) is maintained.

Regarding claims 2 and 16, Applicants argued that Bar-Noy does not teach partitioning colors in sets and ordering the sets so that colors in higher sets cost more than colors in lower sets (Remarks page 10 first full paragraph). The Examiner respectfully traverses. It is submitted that as previously cited, Bar-Noy on page 8, section 2.1 paragraph 2 teaches this limitation. The colors are placed into sets ranging from 1 to c. The colors are represented as Phi(v)=i. As the color increases, the independent set (IS) Ci increases. Therefore, the Examiner submits that Bar-Noy teaches partitioning colors in sets and ordering the sets so that colors in higher sets cost more than colors in lower sets.

Regarding claims 3 and 17, Applicants argued that Bar-Noy does not teach a link representing a location of a component of the line system being designed (Remarks page 10 second full paragraph). The Examiner respectfully traverses this argument because at page 20 fifth paragraph, Bar-Noy teaches communication links connecting every pair of adjacent processors. Therefore the communication links represent the location of the processors with respect to other processors.

Regarding claims 4 and 18, Applicants argued that Bar-Noy does not teach the cost of a link in a coloring being equal to the cost of the most expensive set such that a demand going through the link is colored with a color in the most expensive set (Remarks page 10 last paragraph). However, the Examiner respectfully traverses because this limitation is taught in Bar-Noy at section 3. Page 9 section 3.1 teaches the cost of a link in a coloring being equal to the cost of the most expensive set. The demand being colored with a color in the most expensive set is taught at page 11 Claim 3.3.

Regarding claims 5 and 19, Applicants argued that Bar-Noy does not teach colors being assigned to the demands such that no two demands routed on the same link of the graph are assigned the same color. The Examiner respectfully traverses this argument, as this limitation is taught at page 5 paragraph 1, where adjacent vertices (those sharing the same link) are assigned distinct colors.

In view of the discussion above, the rejection of claims 1-7, 9, 15-21, 23-24 and 26-29 under 35 USC 103(a) is maintained.

Request for Information

5. A requirement for information under 37 CFR 1.105 is **not** being made at this time. However, Applicants are respectfully requested to provide the below listed material. These references were cited in a document authored by the inventors of the instant application (entitled "Line System Design and a Generalized Coloring Problem"), discovered by the Examiner during examination. These references were not submitted in an IDS; however, they may be essential to the examination of the instant application.

- V. Kumar. "Approximating Circular Arc Coloring and Bandwidth Allocation in All-Optical Ring Networks." Proc. 1wt Int. Workshop on Approximation Algorithms for Combinitorial Problems, Lecture Notes in Comput. Sci., Springer-Verlag, 147-158, 1998.
- S. Nicoloso, X. Song and M. Sarrafzadeh. "On the Sum Coloring Problem on Interval Graphs." Algorithmica 23, 109-126, 1999.
- A.E. Ozdaglar and D.P. Bertsekas. "Routing and Wavelength Assignment in Optical Networks." IEEE/ACM Transactions on Networking, Vol. 11, pp. 259-272, April 2003.
- R. Ramaswami and K. N. Sivarajan. "Routing and Wavelength Assignment in All-Optical Networks." IEEE/ACM Transactions on Networking, Vol. 3, pp 489-499, Oct. 1995.
- P. Winkler and L. Zhang. "Wavelength Assignment and Generalized Interval Graph Coloring." Proc. Symposium on Discrete Algorithms (SODA), pp. 830-831, 2003.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-7, 9, 15-21, 23, and 29 are rejected under 35 U.S.C. 103(a) as being obvious over Bar-Noy et al., "On Chromatic Sums and Distributed Resource Allocation," Information and Computation 140, 183-202, 1998.

As per claims 1, 15 and 29,

Bar-Noy discloses a method of designing a line system, the method comprising the steps of:

- Obtaining a set of one or more demands for use in computing the line system design (**page 5, Applications first paragraph**, *allocating resources to run jobs and requests*); and
- Representing the line system design as a graph in accordance with a graph coloring operation wherein colors are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost (**page 5, Chromatic Sums of Graphs**, *minimum edge color sum*).

It is clearly anticipated that the disclosed equations and formula would be executed on a computer having a memory on a processor, or by a computer-readable medium, as can be seen by the relative complexity of the equations and formula. This can also be seen by the numerous cited references in the Bar-Noy et al. reference dealing with Computer Programming as well as Computing in general.

Bar-Noy does not disclose expressly the colors representing bandwidths. However, **section 5 of the reference, beginning on page 19** discusses the application of the coloring algorithm to the resource allocation problem. Bandwidth is defined as the amount of data that

can be sent over a network in a given time. Since in a network total bandwidth cannot exceed a given amount, it is obvious that in a network, bandwidth is a resource to be allocated to the processors of the network in order to execute jobs. In order to minimize the time it takes to complete all tasks, it is necessary to develop a schedule that allocates resources, i.e., bandwidth to the jobs of the processors (**page 20 paragraph 5**). Therefore, it would have been obvious to one of ordinary skill in the art of processor schedule optimization, at the time of the present invention, to modify the teachings of Bar-Noy by assigning the colors to bandwidths and bandwidths to the demands (jobs) in order to achieve the minimum total design cost. The motivation for doing so, as taught by Bar-Noy, would have been to minimize response time and gain an optimal scheduling algorithm by allocating bandwidth (page 20 lines 1-5).

As per claims 2 and 16,

Bar-Noy discloses the colors being partitioned in sets and the sets being ordered so that colors in higher sets cost more than colors in lower sets (**page 8, section 2.1 paragraph 2,** *independent sets by coloring*).

As per claims 3 and 17,

Bar-Noy discloses a link of the graph representing a location of a component of the line system being designed (**page 20 paragraph 5**).

As per claims 4 and 18,

Bar-Noy discloses the cost of a link in a coloring being equal to the cost of the most expensive set (**page 9 section 3.1**) such that a demand going through the link is colored with a color in the most expensive set (**page 11 claim 3.3**).

As per claims 5 and 19,

Bar-Noy discloses colors being assigned to the demands such that no two demands routed on the same link of the graph are assigned the same color (**page 5 paragraph 1**).

As per claims 6 and 20,

Bar-Noy discloses the line system being a linear line system (**page 7 first full paragraph**, *"line graph"*).

As per claims 7 and 21,

Bar-Noy discloses the line system being a linear line system (**page 7 first full paragraph**, *"interval graph"*).

As per claims 9 and 23,

Bar-Noy discloses the graph coloring operation being polynomially computable (**page 7 first full paragraph**, *"polynomial time"*).

8. Claims 10, 12-13, 24, and 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bar-Noy as applied to claims 1-7, 9, 15-21, 23, and 29 above, in view of Shih et al., "An

Approximation Algorithm for Coloring Circular-Arc Graphs," Siam Conference on Discrete Mathematics, 1990.

As per claims 10 and 24,

Bar-Noy does not disclose expressly the system being a circular line system. Shih discloses an algorithm for applying the minimum coloring algorithm to systems wherein the systems are circular line systems (**page 2 first paragraph lines 1-5**).

It would have been obvious to one of ordinary skill in the art of graph coloring, at the time of the present invention, to modify Bar-Noy's graph coloring method by employing Shih's circular line system. The motivation would have been to improve ease of use by employing circular-line systems verses linear or interval systems (Shih page 2 first paragraph lines 14-16).

As per claims 12 and 26,

When modified with Bar-Noy, it is obvious that one of Shi's links of the graph (**endpoints page 2 paragraph 2 lines 1-2**) would represent a location of a component of the circular line system being designed. This is similar to Bar-Noy's nodes in claim 3.

As per claims 13 and 27,

Shih discloses a demand being routed either clockwise or counter-clockwise (**page 2 paragraph 2 lines 2-5**, *demands being placed on arcs*), and the colors being assigned to demands such that no two demands routed on the same link are assigned the same color (**page 3 last paragraph line 3-page 4 line 3**).

9. Claims 14 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bar-Noy as applied to claims 1-7, 9, 15-21, 23, and 29 above, in view of Ramaswami et al., "Routing and Wavelength Assignment in All-Optical Networks," IEEE/ACM Transactions on Networking, Vol. 3, pp 489-499, 1995.

Bar-Noy does not disclose expressly the system being a optical line system. Ramaswami discloses an algorithm for applying a minimum cost algorithm to systems wherein the systems are circular line systems (**abstract paragraph 2, paragraph 3 lines 1-6**).

It would have been obvious to one of ordinary skill in the art of graph coloring, at the time of the present invention, to modify Bar-Noy's graph coloring method by employing Ramaswami's optical line system. The motivation would have been to increase flexibility of Bar-Noy's method by employing an optical line system as opposed to a linear or interval system (Ramaswami page 4 lines 5-9, using both circuit-switched and optical networks).

Allowable Subject Matter

Claim8, 11, 22 and 25 allowed.

10. The following is an examiner's statement of reasons for allowance:

As per claims 8 and 22,

Although the prior art of record teaches using Big-Oh approximations for graph coloring operations (Bar-Noy section 3.2 second paragraph), where s, or in this case k, is a value

proportional to a number of color sets, the reference does not teach the approximation being O(sqrt(s)), as expressly claimed, and as defined in the specification as a O(sqrt(s)) approximation for (L, *, *) problems (specification page 13 line 17-page 14 line 6).

As per claims 11 and 25,

Although the prior art of record teaches using approximations for the graph coloring operations (Shih page 11 theorem 3.6), the reference does not teach the approximation being 2(1+epsilon), as expressly claimed, and as defined in the specification as a 2(1+epsilon) approximation for a (C, U, E) problem with a constant step size (specification page 9 line 15-page 11 line 15).

11. As stated in MPEP § 2131.02, "The identical invention must be shown in as complete detail as is contained in the ... claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an ipsissimis verbis test, i.e., identity of terminology is not required. In re Bond, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990). Therefore, the prior art of record does not anticipate, render obvious or read on the claims and the claims do not read on the prior art.

12. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimberly Thornewell whose telephone number is (571)272-6543. The examiner can normally be reached on 9am-5:30pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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